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In Reply Refer To:

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02-21-04-F-0008

February 15, 2005

Mr. Michael E. Virgin
Director, Joint Programs
Arizona Department of Emergency and Military Affairs
5636 East McDowell Road
Building M5101
Phoenix, Arizona 85008-3495

Subject: Biological Opinion on Camp Navajo Army Depot Firing Range Expansion Project

Dear Mr. Virgin:

Thank you for your request for formal consultation with the U.S. Fish and Wildlife Service pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request for formal consultation was dated October 27, 2004, and received by us on November 12, 2004. This consultation concerns the possible effects of the proposed Arizona Army National Guard (AZARNG) Camp Navajo Army Depot Firing Range Expansion Project, Coconino County, Arizona, on the threatened Mexican spotted owl (*Strix occidentalis lucida*) (MSO) and the threatened bald eagle (*Haliaeetus leucocephalus*). The purpose of the proposed project is to provide adequate weapons practice and qualification facilities for National Guard unit training in northern Arizona. The AZARNG has determined that the project will have no effect on designated critical habitat for the MSO. Therefore, we will not discuss critical habitat for the MSO further in this letter.

This biological opinion is based on information provided in the October 2004 Environmental Assessment (EA), formal correspondence, field visits, meeting notes and electronic mail transmissions, and other sources of information compiled on this project. Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

Consultation History

Details of the consultation history are summarized in Table 1.

Table 1. Summary of Consultation History

<i>Date</i>	<i>Event</i>
December 7, 2001	The AZARNG gave a presentation of the proposed expansion of the existing firing range and discussed alternatives with the Fish and Wildlife Service.
October 20, 2003	The AZARNG and Fish and Wildlife Service participated in a conference call to discuss the proposed firing range.
January 23, 2004	We discussed the proposed project with Harris Environmental, the AZARNG's consultant on the project.
February 17, 2004	We met with Harris Environmental and the AZARNG to discuss the proposed project.
April 19, 2004	We received the April 2004 Draft EA and a request for formal consultation from the AZARNG.
August 16, 2004	The AZARNG informed us of a significant change to the proposed project and withdrew their request for formal consultation.
November 12, 2004	We received your request for formal consultation on the revised project and the October 2004 Draft EA.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Camp Navajo is located in north-central Arizona, 12 miles west of Flagstaff and adjacent to the small community of Bellemont, on Interstate 40. The installation is approximately 28,372 acres in size and is used for a variety of AZARNNG training, munitions/missile storage, and maintenance missions. The AZARNNG proposes to develop an expanded Small Arms Range Complex at Camp Navajo. The current small arms range does not support the training of soldiers to current Army standards. The proposed complex would allow complete weapons training and qualification for AZARNNG units in northern Arizona.

The AZARNNG used Ammunition and Explosive Safety Standards (Department of Army Pamphlet 385-64) to determine the most feasible site for the range complex within the installation. Based on these standards and current land uses within Camp Navajo, the northwestern portion of the installation was determined to be the most feasible site for the expanded range complex (Township 22 North, Range 5 East, Sections 31 and 32, and Township 21 North, Range 5 East, Sections 4, 5, 6, 7, 8, and 9, Gila and Salt River Meridian). Within this area, the proposed range complex will overlap and lay adjacent to the existing small arms range. This location contains existing paved roads and utilities, is located near personnel facilities, and would maintain the Surface Danger Zone (SDZ) within the installation's boundaries. An SDZ is the ground and airspace designated within the training complex (to include associated safety areas) for vertical and lateral containment of projectiles, fragments, debris, and components resulting from the firing, launching, or detonation of weapon systems (ammunition, explosives, and demolition explosives). The objective of SDZs is to minimize the risk of weapons fragment escape or other firing range danger to the public. The standard is to allow no greater than a one in one million residual risk of fragment escape or other danger to the public.

The range complex would be developed on approximately 330 acres and would contain five firing ranges. The five ranges would consist of the following:

- M16 Modified Record Fire Range (MRF)
 - 400 meter (m) M249 Automatic Rifleman Mode Range
 - 800 m M249 Squad Automatic Weapon (SAW) Mode Range
 - 600 m Known Distance Range
 - 300 m Known Distance Range
 - 10 m Machine Gun Range
- 40 millimeter (mm) Range for M203 Grenade Launcher
- Practice Hand Grenade Range
- M72 (AT-4) Range
- 9 mm Combat Pistol Qualification Course (CPQC)

The current small arms range is used by approximately 475 AZARNG soldiers per month from April to October (typically one or two weekends per month). The majority of all training occurs in the spring, summer, and fall months as winter weather limits range use. The proposed expanded range would be used by approximately the same number of personnel and during similar time periods as the existing range. However, the new training standards will require that each soldier fire an increased number of rounds and will allow for night firing. In addition, the pistol range is used by non-military law enforcement personnel throughout the year and approximately 40 hunters typically use the area from September through December.

Construction of the Camp Navajo Small Arms Range Complex and associated facilities would occur in three phases. Phase 1 would consist of development of the M16 MRF Range. Approximately 220 acres of disturbance would occur during Phase I development and should take approximately three to six months (see Table 1, page 11 of the Draft EA). Phase II would include the development of the remaining weapons practice ranges, including the 9 mm CPQC Range, M72 AT-4 Range, Grenade Launcher Range, and Hand Grenade Qualification Course (see Table 2, page 13 of the Draft EA).

The SDZ for the MRF Range would consist of 875 acres and the SDZ for all practice ranges will total 1,022 acres. Disturbance within this area will be limited to forest and fire management efforts. No construction activities will occur within the SDZ. Cinder fire break roads would be constructed within 100 m of the edge of each range and security gates added to limit access. The fire breaks will be burned yearly to reduce ignition sources and fire hazards. Approximately 123 acres between the M16 MRF Range and the cinder fire break road (20-foot wide cinder fuelbreak) and 69 acres between the other ranges and the cinder fire break road would undergo yearly fire prevention treatments, such as prescribed fire, to reduce ground fuels and minimize wildfire dangers.

Phase III of the range complex development would be the construction of support facilities for the 9 mm CPQC Range, the M72 AT-4 Range, the Grenade Launcher Range, and Hand Grenade Qualification Course. Construction activities associated with Phase II and Phase III would be concentrated within and adjacent to firing ranges and will impact approximately 110 acres.

Within the next five years, AZARNG plans to investigate the use of non-lead based “green” ammunition to reduce the potential adverse effects of lead within the installation. The use of green ammunition is not required, may be cost prohibitive, and may not meet ballistic training needs. However, the AZARNG has agreed to consider it as a future option.

Conservation Measures

The following measures will be implemented as part of the proposed action:

- All activities that may cause disturbance to bald eagle roost and forage sites within Camp Navajo would be avoided when feasible. Specifically, activities within the proposed firing range complex would be minimized from October 15 to April 15.

- During winter months, when bald eagles are present in the area, activities at the proposed firing range complex would be concentrated between the hours of 1000 to 1600 hours, when possible, minimizing the potential disturbance to roosting bald eagles.
- Winter raptor surveys would continue on a yearly basis. These surveys would assist in determining the presence of bald eagles and locating potential roost sites.
- Prior to any range use, a visual scan of the range would be made for the presence of large raptors, including bald eagles and MSO. Trained personnel will conduct these searches. If large raptors are observed during initial scans of the range area, the Camp Navajo Natural Resources Specialist would be notified and activities halted until species identification and clearance of activities are provided. If no large raptors are observed prior to range use, activities would proceed as planned.
- If a bald eagle winter roost site is located within the vicinity of the range complex (including SDZs), bald eagles at the site will be monitored during range use to determine the effects of noise and military activity. The AZARNG would continue to analyze winter raptor and breeding bird survey data to determine patterns of habitat use within the action area and implement beneficial management actions.
- Firing range targets will be configured in such a way as to avoid large diameter trees and snags.
- Trees left within proposed firing ranges would be monitored to assess long-term damage from training rounds. A monitoring program for forested areas within proposed firing ranges and SDZs also may be established to assess forest reproduction and recruitment. Monitoring would be conducted under the Land Condition Trend Analysis component of the AZARNG Integrated Training Area Management Program.
- Roadways and areas disturbed during construction activities that would not be needed for the proposed range complex would be re-vegetated with native plant species.
- Mechanical thinning and prescribed burning within the firebreak perimeters would be conducted in order to minimize the risk of wildfire spreading to potential MSO habitat and bald eagle roosting habitat.
- AZARNG would continue to conduct biennial MSO surveys within Camp Navajo in accordance with the recommended Fish and Wildlife Service protocol.

STATUS OF THE SPECIES

Mexican Spotted Owl

The MSO was listed as a threatened species in 1993 (USDI 1993). The primary threats to the species were cited as even-aged timber harvest and catastrophic wildfire, although grazing, recreation, and other land uses were also mentioned as possible factors influencing the MSO

population. The Fish and Wildlife Service appointed the Mexican Spotted Owl Recovery Team in 1993, which produced the Recovery Plan for the Mexican Spotted Owl (Recovery Plan) in 1995 (USDI 1995a). The final MSO critical habitat rule (USDI 2004) designated approximately 8.6 million acres of critical habitat in Arizona, Colorado, New Mexico, and Utah, mostly on Federal lands (USDI 2004). Within this larger area, proposed critical habitat is limited to areas that meet the definition of protected and restricted habitat, as described in the Recovery Plan.

A detailed account of the taxonomy, biology, and reproductive characteristics of the MSO is found in the Final Rule listing the MSO as a threatened species (USDI 1993) and in the Recovery Plan (USDI 1995a). The information provided in those documents is included herein by reference. Although the MSO's entire range covers a broad area of the southwestern United States and Mexico, the MSO does not occur uniformly throughout its range. Instead, it occurs in disjunct localities that correspond to isolated forested mountain systems, canyons, and in some cases steep, rocky canyon lands. Surveys have revealed that the species has an affinity for older, uneven-aged forest, and the species is known to inhabit a physically diverse landscape in the southwestern United States and Mexico.

The U.S. range of the MSO has been divided into six recovery units (RU), as discussed in the Recovery Plan. The proposed project under consideration in this biological opinion is within the Upper Gila Mountains RU. The Upper Gila Mountains RU is a relatively narrow band bounded on the north by the Colorado Plateau RU and to the south by the Basin and Range-West RU. The southern boundary of this RU includes the drainages below the Mogollon Rim in central and eastern Arizona. The eastern boundary extends to the Black, Mimbres, San Mateo, and Magdalena mountain ranges of New Mexico. The northern and western boundaries extend to the San Francisco Peaks and Bill Williams Mountain north and west of Flagstaff, Arizona. This is a topographically complex area consisting of steep foothills and high plateaus dissected by deep, forested drainages. This RU can be considered a "transition zone" because it is an interface between two major biotic regions: the Colorado Plateau and Basin and Range Provinces (Wilson 1969). The Kaibab, Coconino, Apache-Sitgreaves, Tonto, Cibola, and Gila National Forests administer most habitat within this RU. The north half of the Fort Apache and northeastern corner of the San Carlos Indian reservations are located in the center of this RU and also support MSO.

The Upper Gila Mountains RU consists of pinyon/juniper woodland, ponderosa pine/mixed conifer forest, some spruce/fir forest, and deciduous riparian forest in mid- and lower-elevation canyon habitat. Climate is characterized by cold winters and over half the precipitation falls during the growing season. Much of the mature stand component on the gentle slopes surrounding the canyons had been partially or completely harvested prior to the species' listing as threatened in 1993; however, MSO nesting habitat remains in steeper areas. MSO are widely distributed and use a variety of habitats within this RU. Owls most commonly nest and roost in mixed-conifer forests dominated by Douglas fir and/or white fir, and canyons with varying degrees of forest cover (Ganey and Balda 1989, USDI 1995a). Owls also nest and roost in ponderosa pine-Gambel oak forest, where they are typically found in stands containing well-developed understories of Gambel oak (USDI 1995a).

Historical and current anthropogenic uses of MSO habitat include both domestic and wild ungulate grazing, recreation, fuels reduction treatments, resource extraction (e.g., timber, oil, gas), and development. These activities have the potential to reduce the quality of MSO nesting, roosting, and foraging habitat, and may cause disturbance during the breeding season. Livestock and wild ungulate grazing is prevalent throughout Region 3 National Forest lands and is thought to have a negative effect on the availability of grass cover for prey species. Recreation impacts are increasing on all forests, especially in meadow and riparian areas. There is anecdotal information and research that indicates that owls in heavily used recreation areas are much more erratic in their movement patterns and behavior. Fuels reduction treatments, though critical to reducing the risk of catastrophic wildfire, can have short-term adverse effects to MSO through habitat modification and disturbance. As the population grows, especially in Arizona, small communities within and adjacent to National Forest System lands are being developed. This trend may have detrimental effects to MSO by further fragmenting habitat and increasing disturbance during the breeding season. West Nile Virus also has the potential to adversely impact the MSO. The virus has been documented in Arizona, New Mexico, and Colorado and preliminary information suggests that owls may be highly vulnerable to this disease. Unfortunately, due the secretive nature of owls and the lack of intensive monitoring of banded individual birds, we will most likely not know when owls contract the disease or the extent of its impact to MSO.

Currently, high-intensity, stand-replacing fires are influencing ponderosa pine and mixed conifer forest types in Arizona and New Mexico. MSO in the southwestern United States has been shaped over thousands of years by fire. Since MSO occupy a variety of habitats, the influence and role of fire has most likely varied throughout the owl's range. In 1994, at least 40,000 acres of nesting and roosting habitat were impacted to some degree by catastrophic fire in the Southwestern Region (Sheppard and Farnsworth 1995). Between 1991 and 1996, the Forest Service estimated that approximately 50,000 acres of owl habitat has undergone stand-replacing wildfires (G. Sheppard, Forest Service, Kaibab National Forest, Arizona, pers. comm.). However, since 1996, fire has become catastrophic on a landscape scale and has resulted in hundreds of thousands of acres of habitat lost to stand-replacing fires. This is thought to be a result of unnatural fuel loadings, past grazing and timber practices, and a century of fire suppression efforts. The 2002 Rodeo-Chediski fire, at 462,384 acres, burned through approximately 55 PACs on the Tonto and Apache-Sitgreaves National Forests and the White Mountain Apache Reservation. Of the 11,986 acres of PAC habitat that burned on National Forest lands, approximately 55% burned at moderate to high severity. Based on the fire severity maps for the fire perimeter, tribal and private lands likely burned in a similar fashion. We define moderate severity burn as high scorch (trees burned may still have some needles) and high severity burn as completely scorching all trees (trees completely dead).

Currently, catastrophic wildfire is probably the greatest threat to MSO within the Upper Gila Mountains RU. As throughout the West, fire intensity and size have been increasing within this geographic area. Table 2 shows several high-intensity fires that have had a large influence on MSO habitat in this RU in the last decade. Obviously the information in Table 2 is not a comprehensive analysis of fires in the Upper Gila Mountains RU or the effects to MSO. However, the information does illustrate the influence that stand-replacing fire has on current and future MSO habitat in this RU. This list of fires alone estimates that approximately 11% of

the PAC habitat within the RU suffered high-to moderate-intensity, stand-replacing fire in the last seven years.

Table 2. Some recent influential fires within the Upper Gila Mountains Recovery Unit, approximate acres burned, number of PACs affected, and PAC acres burned.

Fire Name	Year	Total Acres Burned	# PACs Burned	# PAC Acres Burned
Rhett Prescribed Natural Fire	1995	20,938	7	3,698
Pot	1996	5,834	4	1,225
Hochderffer	1996	16,580	1	190
BS Canyon	1998	7,000	13	4,046
Pumpkin	2000	13,158	4	1,486
Rodeo-Chediski	2002	462,384	55	~33,000
TOTAL		525,894	84	~43,645

A reliable estimate of the numbers of owls throughout its entire range is not currently available (USDI 1995a) and the quality and quantity of information regarding numbers of MSO vary by source. USDI (1991) reported a total of 2,160 owls throughout the United States. Fletcher (1990) calculated that 2,074 owls existed in Arizona and New Mexico. However, Ganey *et al.* (2000) estimates approximately $2,950 \pm 1,067$ (SE) MSOs in the Upper Gila Mountains RU alone. The Forest Service Region 3 most recently reported a total of approximately 980 protected activity centers (PACs) established on National Forest lands in Arizona and New Mexico (USDA Forest Service, Southwestern Region, December 19, 2002). Based on this number of MSO sites, total numbers in the United States may range from 980 individuals, assuming each known site was occupied by a single MSO, to 1,960 individuals, assuming each known site was occupied by a pair of MSOs. The Forest Service Region 3 data are the most current compiled information available to us; however, survey efforts in areas other than National Forest System lands have likely resulted in additional sites being located in all Recovery Units. Currently, we estimate that there are likely 12 PACs in Colorado (not all currently designated) and 105 PACs in Utah.

Researchers studied MSO population dynamics on one study site in Arizona ($n = 63$ territories) and one study site in New Mexico ($n = 47$ territories) from 1991 through 2002. The initial publication of the findings reported that both study populations were declining at $\geq 10\%$ a year and that owl survival rates in Arizona may be declining over time (Seamans *et al.* 1999). The authors noted two possible reasons for the population decline were declines in habitat quality and regional trends in climate. The Final Report, titled “Temporal and Spatial Variation in the Demographic Rates of Two Mexican Spotted Owl Populations,” (*in press*) found that reproduction varied greatly over time, while survival varied little. The estimates of the population rate of change ($\Lambda = \text{Lamda}$) indicated that the Arizona population was stable (mean Λ

from 1993 to 2000 = 0.995; 95% Confidence Interval = 0.836, 1.155) while the New Mexico population declined at an annual rate of about 6% (mean Λ from 1993 to 2000 = 0.937; 95% Confidence Interval = 0.895, 0.979). The study concludes that spotted owl populations could experience great (>20%) fluctuations in numbers from year to year due to the high annual variation in recruitment. However, due to the high annual variation in recruitment, the MSO is then likely very vulnerable to actions that impact adult survival (e.g., habitat alteration, drought, etc.) during years of low recruitment.

Since the owl was listed, we have completed or have in draft form a total of 144 formal consultations for the MSO. These formal consultations have identified incidences of anticipated incidental take of MSO in 334 PACs. The form of this incidental take is almost entirely harm or harassment. These consultations have primarily dealt with actions proposed by the Forest Service, Region 3. However, in addition to actions proposed by the Forest Service, Region 3, we have also reviewed the impacts of actions proposed by the Bureau of Indian Affairs, Department of Defense (including Air Force, Army, and Navy), Department of Energy, National Park Service, and Federal Highway Administration. These proposals have included timber sales, road construction, fire/ecosystem management projects (including prescribed natural and management ignited fires), livestock grazing, recreation activities, utility corridors, military and sightseeing overflights, and other activities. Only two of these projects (release of site-specific owl location information and existing forest plans) have resulted in biological opinions that the proposed action would likely jeopardize the continued existence of the MSO.

Bald Eagle

The bald eagle south of the 40th parallel was listed as endangered under the Endangered Species Preservation Act of 1966, on March 11, 1967 (USFWS 1967), and was reclassified to threatened status on July 12, 1995 (USDI 1995b). No critical habitat has been designated for this species. The bald eagle was proposed for delisting on July 6, 1999 (USDI 1999). The bald eagle is a large bird of prey that historically ranged and nested throughout North America except extreme northern Alaska and Canada, and central and southern Mexico.

Since listing, bald eagles have increased in number and expanded in range due to the banning of DDT and other persistent organochlorine compounds, habitat protection, and additional recovery efforts. Surveys in 1963 indicated 417 active nests in the lower 48 states with an average of 0.59 young produced per nest. Surveys in 1974 resulted in a population estimate of 791 occupied breeding areas in the lower 48 states (USDI 1999). In 1994, 4,450 occupied breeding areas were reported with an estimated average of 1.16 young produced per occupied nest (USDI 1995b). The Fish and Wildlife Service estimates that the breeding population exceeded 5,748 occupied breeding areas in 1998 (USDI 1999).

Although not considered a separate subspecies, bald eagles in the southwestern United States have been considered as a distinct population for the purposes of consultation and recovery efforts under the Act. A recovery plan was developed in 1982 for bald eagles in the Southwest recovery region. However, new information has indicated that the bald eagles in Arizona and the Southwest recovery region are not a distinct, reproductively isolated population as was previously believed. In 1994, a male bald eagle which originated from eastern Texas was

discovered nesting at Luna Lake in east-central Arizona. The origin of the unbanded female was not determinable. The Fish and Wildlife Service has determined that bald eagles in the Southwest recovery region are part of the same bald eagle population found in the remaining lower 48 states (USDI 1995b). The Fish and Wildlife Service proposed delisting of the bald eagle in the lower 48 states including Arizona, stating that the number of breeding pairs in the Southwestern Recovery Unit has more than doubled in the last 15 years (USDI 1999).

However, the Arizona Game and Fish Department (*in prep.*) concluded that “Evidence from the banding and identification of breeding adults defends the theory that Arizona’s breeding population is not supported or maintained by immigration from other states or regions. Because adults return to the vicinity of their natal origin to breed, the large distance between small populations in the Southwest decreases the chance for movement between neighboring populations. Probably most convincing are the results from banding 256 nestlings over 20 years and identifying 372 breeding adults over 8 years. Only one individual from out-of-state entered the breeding population and one left. Additionally, the proportion of breeding adults with color bands (placed on nestlings in Arizona) has steadily increased, while the presence of unmarked eagles has decreased. Thus, continued attention to the survivorship of all Arizona bald eagles is vital to the maintenance of our breeding population. We can not depend on immigration to Arizona from nearby states to make up for poor management in Arizona.”

Bald eagle breeding areas in Arizona are predominantly located in the upper and lower Sonoran life zones. The Luna Lake breeding area is one of the few territories in Arizona that is found in coniferous forests, as opposed to the majority which occur in Sonoran vegetation communities. All breeding areas in Arizona are located in close proximity to a variety of aquatic habitats including reservoirs, regulated river systems, and free-flowing rivers and creeks. The alteration of natural river systems has had both beneficial and detrimental affects to the bald eagle. While large portions of riparian forests were inundated or otherwise destroyed following construction of dams and other water developments, the reservoirs created by these structures enhance habitat for the waterfowl and fish species (often nonnative species) on which bald eagles prey.

Bald eagles in Arizona consume a diversity of food items, including some invertebrates. However, their primary food is fish, which are generally consumed twice as often as birds, and four times as often as mammals. Bald eagles are known to catch live prey, steal prey from other predators (especially osprey), and use carrion. Carrion constitutes a higher proportion of the diet for juveniles and subadults than it does for adult eagles. Diet varies depending on what species are available locally.

In addition to breeding bald eagles, Arizona provides habitat for wintering bald eagles, which migrate through the state between October and April each year. In 1997, the standardized statewide Arizona winter count totaled 343 bald eagles, including 193 adults, 134 subadults, and 16 of unknown age; in 1998, 183 adults, 103 subadults, and 4 of unknown age were recorded. The highest numbers of bald eagles, in both years, occurred on the Verde River and San Carlos Reservoir (Beatty and Driscoll 1999).

Bald eagles are primarily winter visitors to northern Arizona, occupying all habitat types and elevations. Wintering eagles arrive in the fall, usually late October or early November, and leave

in early to mid-April. Management of wintering bald eagles involves protecting three habitat components: foraging areas, daytime perching areas, and night roosts, as well as the eagles that use them (Martell 1992). Managers should provide protection from human disturbance, physical alterations to habitat, environmental contaminants, and loss of food resources (Martell 1992).

Wintering bald eagles feed on fish, waterfowl, terrestrial vertebrates, and carrion. Eagles are often seen perched in trees or snags near roadways where they feed on road-killed animals. At night, small groups or individual eagles roost in clumps of large trees in protected locations such as drainages or hillsides. Key habitat components include nighttime roosts and prey availability. Roost trees are usually large ponderosa pine trees (live or dead) with open canopies on slopes that provide protection from inclement weather.

Even though the bald eagle has been reclassified to threatened, and the status of the birds in the Southwest is on an upward trend, the Arizona population remains small and under threat from a variety of factors. Human disturbance of bald eagles is a continuing threat which may increase as numbers of bald eagles increase and human development continues to expand into rural areas (USDI 1999). The bald eagle population in Arizona is exposed to increasing hazards from the regionally increasing human population. These include extensive loss and modification of riparian breeding and foraging habitat through clearing of vegetation, changes in groundwater levels, and changes in water quality. Threats persist in Arizona largely due to the proximity of bald eagle breeding areas to major human population centers and recreation areas. Additionally, because water is a scarce resource in the Southwest, recreation is concentrated along available water courses. Some of the continuing threats and disturbances to bald eagles include entanglement in monofilament fish line and fish tackle; overgrazing and related degradation of riparian vegetation; malicious and accidental harassment, including shooting, off-road vehicles, recreational activities (especially watercraft), and low-level aircraft overflights; alteration of aquatic and riparian systems for water distribution systems and maintenance of existing water development features such as dams or diversion structures; collisions with transmission lines; poisoning; and electrocution (Beatty et al. 1999, Stalmaster 1987). In Arizona, the use of breeding area closures and close monitoring of nest sites through the Arizona Bald Eagle Nestwatch Program (ABENWP) has been and will continue to be essential to the recovery of the species. Ensuring the longevity of the ABENWP is of primary concern to the Fish and Wildlife Service (USDI 1999).

In addition, concentrations of heavy metals in bald eagle eggs are a concern in Arizona. Thirteen Arizona bald eagle eggs collected from 1994 to 1997 contained from 1.01 to 8.02 ppm dry weight mercury (Arizona Game and Fish Department *in prep*). Concentrations in the egg are highly correlated with risk to reproduction. Adverse effects of mercury on bald eagle reproduction might be expected when eggs contain about 2.2 ppm mercury or more. Five of 10 eggs approached or exceeded the 2.2 ppm threshold concentration. What is especially alarming is that mercury concentrations in addled eggs appear to be increasing over time. Addled bald eagle eggs collected in Arizona in 1995-97 contained more than two- to six-times higher concentrations of mercury than eggs collected in 1982-84 (appx. 0.39-1.26 ppm) (K. King pers. comm.).

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat to provide a platform from which to assess the effects of the action now under consultation.

Therefore, for this consultation we are defining the action area as the entire small arms firing range expansion area, including the SDZs.

A. Status of the species within the action area

Mexican Spotted Owl

The Volunteer Canyon protected activity center (PAC) (#040211) was designated on the southern end of the installation, in portions of Volunteer Canyon, extending into the Coconino National Forest. MSO surveys of Camp Navajo have been conducted since 1997, primarily within the southern and western portions of the installation. Adult MSO and potential juveniles were heard within the PAC on Camp Navajo during the summer of 2000. MSO were located primarily along the rim and side drainages of Volunteer Canyon near the installation's southern boundary with the Coconino National Forest. MSO surveys conducted in the summers of 2002, 2003, and spring 2004 did not locate MSO in the OB/OD Area (Camp Navajo portion of the Volunteer Canyon PAC) or in suitable habitat within the installation. However, during the 2002 survey period, a large unidentified raptor was observed during night calling, and surveys in 2003 were not conducted to protocol due to logistical constraints. Designated critical habitat for the MSO is located along the southern portion of the installation and includes the majority of Volunteer Canyon. The critical habitat and the PAC occur approximately 4.8 miles and 5.2 miles, respectively, south of the proposed small arms range.

MSO habitat (as defined in the Recovery Plan) also occurs along the western portion of the installation, adjacent to and within the proposed project area. A telemetry study in the fall of 1995 found that a dispersing juvenile MSO spent approximately 2 weeks in the immediate vicinity of Volunteer Mountain (within the project area) before dispersing onto the Kaibab National Forest Joe Ganey, Forest Service Experimental Station, Flagstaff, AZ (pers. comm.). Therefore, the protected and restricted habitat within the Camp Navajo facility could serve as an important corridor for dispersing owls.

Bald Eagle

Bald eagles are known to occur on Camp Navajo from about mid-October to mid-April (Ingraldi and Bayless 2004, Ingraldi 2001, Texas Regional Institute for Environmental Studies 1996). As many as 13 bald eagles have been observed in one day on the installation during winter raptor surveys conducted at Camp Navajo (Ingraldi and Bayless 2004). A winter bald eagle roost site was discovered near Johnson Tank during the winter of 2003/2004 as a result of an Arizona Game and Fish Department (AGFD) radio-tagging project at Camp Navajo. The Johnson Tank bald eagle winter roost site is located in close proximity (approximately 0.13 mile) from the proposed M72 Range. The bald eagles at Johnson Tank were roosting in large, live ponderosa pines and snags. Additional bald eagle winter roost sites are suspected to exist in other areas of Camp Navajo. Bald eagles do not breed within the action area.

B. Factors affecting the species' environment within the action area

Mexican Spotted Owl

Actions within the project area that may affect MSO include on-going operations within the Open Burning-Open Detonation Area (OB/OD) and the installation's proposed fuels reduction plan. The Volunteer Canyon PAC, except for activities conducted by the National Guard Bureau in the OB/OD Area, is in an access-limited area within Camp Navajo, so there is currently very little disturbance within this area. The AZARNG has implemented and will continue to implement future fuels reduction treatments in MSO habitat. However, the AZARNG intends to follow the recommendations in the Recovery Plan for these actions.

Bald Eagle

Actions within the project area that affect bald eagles include: on-going research by the AGFD, the presence of a wind turbine, and disturbance from National Guard training activities and operations. The AGFD is conducting a study that involves the capture and banding of wintering bald eagles at Camp Navajo. This activity may increase stress to wintering eagles and could result in injury or harm. The wind turbine was installed in 2003 and we anticipated that one bald eagle could be injured and/or killed as a result of direct effects from the turbine. To date, monitoring indicates that no eagles have died as a result of turbine operation. Camp Navajo exists to support military training for the AZARNG and is used by both Army and Air National Guard units (transportation, engineer, military police, aviation, ordnance, medical, quartermaster, and other branches) for annual and weekend training. Additionally, Camp Navajo is used as a training site by both active component and other reserve component units of all services. The Limited Area, where most of the wintering eagles have been found and where the trapping stations are located, consists mostly of munitions storage igloos. Hunting is also permitted in this area. However, though only one winter roost site has been confirmed at Camp Navajo, habitat exists throughout the installation and the potential exists for activities to cause disturbance to roosting eagles.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

The direct and indirect effects of the proposed action to MSO and bald eagles include habitat disturbance (including fire and fuels management actions), noise disturbance, and potential injury or death.

Effects to the Mexican Spotted Owl

We do not expect any impact to known MSO within the Volunteer Canyon PAC; however, dispersing MSO use the installation and habitat in the project area. Therefore, our analysis of effects assumes that MSO could be present at any time within the protected boundary due to the amount of restricted and potential habitat present.

Habitat Disturbance

There are approximately 975 acres of MSO restricted and protected steep-slope habitat within the proposed project area (including the SDZ). Implementation of the proposed project will result in disturbance to approximately 330 acres of restricted pine-oak and protected steep-slope mixed conifer habitat, and development and use of 25 acres of restricted pine-oak and protected steep-slope mixed conifer habitat.

The effects of prescribed fire include both negative and beneficial effects on MSO habitat. Beneficial aspects would include increased response of herbaceous vegetation after a fire. Negative effects would include the near-term loss of herbaceous cover, down logs, and snags. Broadcast burning is expected to decrease woody debris by approximately 50% of existing volume and decrease the number of snags by 20% across all acres burned (Randall-Parker and Miller 2000). The effects of fire on the prey base of the MSO are complex and are dependent on the variations in fire characteristics and in prey habitat. Fire intensity, size, and behavior are influenced by numerous factors such as vegetation type, moisture, fuel loads, weather, season, and topography. Fire can effectively alter vegetation structure and composition, thereby affecting small mammal habitat. The initial effects of fire are likely to be detrimental to rodent populations as cover and plant forage species would be reduced.

Population responses by small mammals to fire-induced changes in their habitat vary. For example, deer mouse populations might increase immediately following fire and then decrease through time (Ward and Block 1995). Campbell *et al.* (1977) noted that populations of peromyscid mice decreased immediately following fire in an Arizona ponderosa pine forest that removed one-fourth (moderately burned) to two-thirds (severely burned) of the basal area;

populations then returned to pre-fire numbers two years following the burn. Further, no differences were found in rodent populations between moderately and severely burned areas. They concluded that the effects of the fire that they studied were short-term, and the short-term positive numerical responses of mice were attributed to an increase in forage, particularly grasses and forbs after the fire (Ward and Block 1995). Irvine (1991) documented post-fire declines in deer mice populations at study sites on the Coconino National Forest. Irvine attributed these declines to reduced food supplies. Lowe *et al.* (1978) noted an increase in deer mice populations the first year after a fire in ponderosa pine near Flagstaff, Arizona. However, small mammal diversity and densities are typically depressed for one to three years after a fire (Wright and Bailey 1982). Biswell *et al.* (1973) suggested that rodent populations would be less affected during fall fires, because at that time of year rodents have accumulated seed caches that will mitigate loss of food sources. Predation of surviving rodents that are part of the diet of the MSO may increase immediately after the fire. In one study in northern California, radio-transmitted northern spotted owls spent considerable time in burned-over areas. This activity was assumed to be due to easy capture of prey (Patton and Gordon 1995). In summary, the effects of proposed burning on the foraging habitat of MSO are variable.

Noise Disturbance

Noise associated with the proposed action will not impact the Volunteer Canyon PAC, as it is 5.2 miles south of the action area. However, we have information that indicates that the action area is used by dispersing MSO, most-likely moving between areas on the Coconino and Kaibab National Forests. Therefore, we are reasonably certain that the potential for MSO to be within the proposed action area is relatively high.

There are a growing number of studies attempting to describe and quantify the impacts of non-lethal disturbance on the behavior and reproduction of wildlife, and MSO in particular. Delaney *et al.* (1997) reviewed literature on the response of owls and other birds to noise and concluded the following: 1) raptors are more susceptible to disturbance-caused nest abandonment early in the nesting season; 2) birds generally flush in response to disturbance when distances to the source are less than approximately 200 feet and when sound levels are in excess of 95 dBA; and 3) the tendency to flush from a nest declines with experience or habituation to the noise, although the startle response cannot be completely eliminated by habituation. Delaney *et al.* (1999) found that ground-based disturbances elicited a greater flush response than aerial disturbances. Our guidance is to limit potentially disturbing activities to areas 0.25 mile from MSO nest sites during the breeding season (March 1 through August 31). This corresponds well with the Delaney *et al.*'s (1999) 0.25 mile threshold for alert responses to helicopter flights. In addition, Delaney *et al.* (1999) found that MSO did not flee from helicopters when caring for young at the nest, but fled readily during the post-fledgling period. This may be a result of optimal fleeing decisions that balance the cost-benefit of fleeing. Frid and Dill (2002) hypothesize that this may be explained using predator risk-disturbance theory and perhaps the cost of an adult MSO fleeing during the nestling period may be higher than during the post-fledgling period.

However, all studies that have examined effects of noise disturbance on MSO have included only territorial owls (Swarthout and Steidl 2001, 2003; Delaney *et al.* 1999). The potential for a

dispersing owl that does not have a strong investment in an area (e.g., mate and/or nest) to react negatively to noise may be greater. There is also evidence that disturbance during years of a diminished prey base (possibly due to the cumulative effects of prescribed burning) can result in lost foraging time which, in turn, may cause some raptors to leave an area (Knight and Cole 1995). In addition, owls possess more sensitive hearing than other birds (Bowles 1995). Topographic screening between the area of disturbance and the bird's location can create a noise buffer, and may assist in the reduction of noise disturbance (Knight and Cole 1995). However, there are few areas within the action area where an MSO could completely escape potential noise impacts from the expanded Small Arms Firing Range.

Habituation to disturbance, though it may occur to some extent, often is partial or negligible (Frid and Dill 2002). It may be that MSO which appear to be "habituated" to human caused disturbance/noise, in reality may have no suitable alternative habitats and remain within areas because other suitable habitat is not available. If the proposed action area is typically used by dispersing MSO, we would not expect the birds to be present long enough to become habituated to the small arms range; especially since most activity will occur only one weekend per month.

Direct Injury and/or Death

Implementation of the proposed action may result in injury or death to MSO during use of the firing range. Rounds from weapons fired within ranges may travel beyond established targets into portions of SDZs containing restricted and protected steep-slope habitat. The likelihood that a round would strike an MSO is extremely low. However, the potential does exist. In addition, MSO are most active at night and the proposed action will include night firing, which may increase the chance of a foraging MSO being shot.

Effects to Bald Eagle

Bald eagles have been observed roosting within the proposed action area. The majority of human activity within the action area would occur between April and September when eagles are absent from the installation. Furthermore, activities during October through March, when bald eagles are present on the installation, are limited by weather constraints.

Habitat Disturbance

Implementation of the proposed action will result in the potential disturbance of approximately 330 acres of ponderosa pine/Gambel oak habitat and mixed conifer forest. Portions of these woodland and forest areas contain potential bald eagle winter roosting habitat. Disturbance to potential bald eagle roosting habitat may occur through mechanical removal of trees during the development of firing ranges and during fire management with the range complex (including SDZs).

Prescribed burns would occur between April and October, when bald eagles are typically absent from the installation. These management activities, in combination with the proposed Westside Buffer Training Area Forest Thinning and Prescribed Fire Project, would reduce the risk of crown fires that could destroy large areas of roosting habitat. Therefore, the impacts of fire

management activities on bald eagle roost habitat should be minimal. In addition, the on-going snag monitoring project throughout the western section of Camp Navajo (including the Small Arms Range Area) will monitor the effects of forest treatments of wildlife habitat and provide the opportunity for adaptive management if there appear to be negative results from the fuels reduction program.

Noise Disturbance

The Johnson Tank bald eagle winter roost site is located in close proximity to the proposed action area. Although this roost site would not be physically altered by construction of the proposed range complex, the distances to various portions of the complex range from 0.13 mile to 1.1 miles. During the period of bald eagle use of the area (October through April), noise and activity from construction and use of the proposed firing ranges could disturb roosting or foraging birds.

When a sound source arouses an animal, the disturbance may affect metabolic rates by increasing activity levels. This increase activity can deplete energy reserves (Bowles 1995). Noisy human activity can cause raptors to expand their home ranges, but birds often return to normal use patterns when human activity ceases (Bowles 1995). Stalmaster and Kaiser (1997) studied the flushing responses of wintering bald eagles on the Fort Lewis Army Reservation, Washington during 1991-1994. During 373 firing events, 8% of 1,452 eagles flushed. (approximately 45% from ordnance explosions, 9% from automatic weapons fire, 6% from artillery impacts, 4% from mortar impacts, and 3% from small arms fire). They found that flushing by eagles decreased with increasing distance from firing events (16% of eagles flushed at 0.31 to 0.62 mile). Another study found that gunshots and sonic booms within 1.24 miles of nesting eagles caused 10% of birds to flush (Grubb and King 1991), but experimental shooting 0.31 mile from a roost caused most eagles to flush (Smith 1988). Habituation to frequently occurring events, especially by adults, and the need for food and habitat contained in the area, likely explain the apparent tolerance of many eagles to firing and activity (Stalmaster and Kaiser 1997). However, as noted above, habituation to disturbance, though it may occur to some extent, often is partial or negligible (Frid and Dill 2002).

Explosions associated with ordnance disposals have been shown to be disruptive to eagle behavior (Stalmaster and Kaiser 1997). Eagles flushed by ordnance firing activity while perching resumed perching quickly after firing ceased, but eagles flushed while foraging resumed feeding only after long periods (Stalmaster and Kaiser 1997). Disturbances associated with the proposed action may limit the use of winter foraging areas, disrupt foraging behavior, and force eagles to use marginal resources, thereby reducing habitat quality (Stalmaster 1983, 1987). In addition, nighttime use of the firing ranges may disturb eagles on their night roosts. Eagles may be more sensitive to disturbance at night roosts than at other sites.

Injury and/or Death

Use of the proposed firing range may also result in injury or death to bald eagles from stray rounds. The likelihood that a stray round would strike a bald eagle flying or roosting in the area is extremely low, but it could occur during the life of the proposed action. Bald eagles may also

be injured or killed by lead poisoning as a result of feeding on killed or crippled waterfowl or game containing lead shot and/or lead shot inadvertently ingested by waterfowl. All users of the range would be under strict orders to avoid shooting at any wildlife, reducing the likelihood of lead contamination in animals that eagles might ingest.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area to be considered in this biological opinion. Future Federal actions are subject to the consultation requirements established under section 7, and therefore, are not considered cumulative in the proposed action. Future actions within the action area that are reasonably certain to occur are all federally authorized or carried out and are not cumulative to the proposed action.

Conclusion

Mexican Spotted Owl

After reviewing the current status of the MSO, the environmental baseline for the action area, the effects of the proposed project, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the MSO. Our reasons for this conclusion are that no currently known resident owls will be impacted by the proposed action, and the amount of habitat impacted is relatively small compared to habitat available in the Upper Gila Mountains Recovery Unit.

Bald Eagle

After reviewing the current status of the bald eagle, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, will not jeopardize the continued existence of the bald eagle. Our reasons for this conclusion are that the population status of the bald eagle continues to improve overall, and the proposed action includes conservation measures which will lessen the impact of the proposed Small Arms Range Expansion on wintering eagles in northern Arizona.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is

defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the AZARNG so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The AZARNG has a continuing duty to regulate the activity covered by this incidental take statement. If the AZARNG (1) fails to assume and implement the terms and conditions or (2) fails to require the (applicant) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the AZARNG must report the progress of the action and its impact on the species to the FWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Mexican Spotted Owl

We anticipate that two MSO will be taken as a result of the proposed action. We anticipate that one MSO will be taken due to harassment due to noise and/or habitat disturbance. In addition, although unlikely, there is the constant threat that one MSO will be injured and/or killed as a result of impact from either rounds from weapons fired or shrapnel from ordnance explosion within the range.

Bald Eagle

We anticipate that two bald eagles will be taken as a result of the proposed action. We anticipate one bald eagle will be taken due to the harassment due to noise and/or habitat disturbance at known and potential winter roost sites. In addition, although unlikely, there is the constant threat that one bald eagle will be injured and/or killed as a result of impact from with rounds from weapons fired or shrapnel from ordnance explosion within the range.

We will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

EFFECT OF THE TAKE

In this biological opinion we determine that this level of anticipated take is not likely to result in jeopardy to the MSO or bald eagle.

REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

We determine that the proposed action incorporates sufficient measures that reasonably and prudently minimize the effects of incidental take of MSO and bald eagles. All reasonable measures to minimize take have been incorporated into the project description. Thus, no reasonable and prudent measures are included in this incidental take statement.

Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species initial notification must be made to the Fish and Wildlife Service's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care and in handling dead specimens to preserve the biological material in the best possible state.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend that the AZARNG continue to monitor the long-term effects of military training operations on MSO and wintering bald eagle habitat.
2. We recommend that the AZARNG use non-lead based "green" ammunition to reduce the potential adverse effects of lead within the installation. We recognize the AZARNG's willingness to examine this option in five years, but we feel that the sooner a non-lead based ammunition alternative can be found, the less impact there will be on the ecosystem and listed species.
3. We recommend that AZARNG continue to work with the Fish and Wildlife Service to find ways to minimize the impacts of the firing range on wildlife at Camp Navajo.

In order for us to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We appreciate your continued efforts to protect and conserve listed species. For further information please contact Shaula Hedwall or Brenda Smith of our Flagstaff Suboffice at (928) 226-0614.

Please refer to the consultation number 02-21-04-F-0008 in future correspondence concerning this project.

Sincerely,

/s/ Steven L. Spangle
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
(Attn: Steve Helfert)
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Fran Peck, Natural and Cultural Resource Manager, AZARNG, Phoenix, AZ
Thomas Parker, Natural Resources Specialist, Camp Navajo, Bellemont, AZ
Greg Beatty, U.S. Fish and Wildlife Service, Phoenix, AZ
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LITERATURE CITED

- Beatty, G.L. and J.T. Driscoll. 1999. Arizona Bald Eagle Winter Count: 1997-1998. Nongame and Endangered Wildlife Program Technical Report 137. Arizona Game and Fish Department, Phoenix, Arizona.
- Beatty, G.L. and J.T. Driscoll, and J.G. Koloszar. 1999. Arizona Bald Eagle Nestwatch Program: 1998 Summary Report. Nongame and Endangered Wildlife Program Technical Report, Arizona Game and Fish Department, Phoenix, Arizona.
- Biswell, H.H., H.R. Kallander, R. Komarek, R.J. Vogel, and H. Weaver. 1973. Ponderosa fire management. Tall Timbers Research Station. Misc. Publ. No. 2. Tall Timber Research Station, Florida.
- Bowles, A.E. 1995. Responses of wildlife to noise. *In* Wildlife and Recreationists: Coexistence Through Management and Research. Knight, Richard L. and Kevin J. Gutzwiller, editors. Island Press, Washington, D.C. 372 pp.
- Campbell, R.E., M.B. Baker, Jr., P.F. Ffolliott, R.R. Larson, and C.C. Avery. 1977. Wildfire effects on a ponderosa pine ecosystem: an Arizona case study. USDA For. Serv. Res. Pap. RM-191. 12 pp.
- Delaney, D.K., T.G. Grubb, and L.L. Pater. 1997. Effects of helicopter noise on nesting Mexican spotted owls. A report to the U.S. Air Force 49 CES/CEV, Holloman Air Force Base. Project Order No. CE P.O. 95-4. 49 pp.
- Delaney, D.K., T.G. Grubb, P. Beier, L.L. Pater, and M. Hildegard Reiser. 1999. Effects of helicopter noise on Mexican spotted owls. *Journal of Wildlife Management* 63(1):60-76.
- Fletcher, K. 1990. Habitat used, abundance, and distribution of the Mexican spotted owl, *Strix occidentalis lucida*, on National Forest System Lands. U.S. Forest Service, Southwestern Region, Albuquerque, New Mexico. 78 pp.
- Frid, A. and L. Dill. 2002. Human-caused disturbance stimuli as a form of predation risk. *Conservation Ecology* 6(1):11.[online] URL: <http://www.consecol.org/vol6/iss1/art11>
- Ganey, J.L., G.C. White, A.B. Franklin, J.P. Ward, Jr., and D.C. Bowden. 2000. A pilot study on monitoring populations of Mexican spotted owls in Arizona and New Mexico: second interim report. 41 pp.
- Ganey, J.L. and R.P. Balda. 1989. Distribution and habitat use of Mexican spotted owls in Arizona. *Condor* 91:355-361.

- Grubb, T.G. and R.M. King. 1991. Assessing human disturbance to breeding bald eagles with classification tree models. *Journal of Wildlife Management* 55(3):500-511.
- Gutierrez, R.J., A.B. Franklin, and W.S. Lahaye. 1995. Spotted owl (*Strix occidentalis*). In *The Birds of North America*, No. 179 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.
- Hammitt, W.E. and D.N. Cole. 1987. *Wildland recreation: ecology and management*. John Wiley and Sons, New York. 341 pp.
- Ingraldi, M. 2001. Winter raptor inventory on Camp Navajo, Bellemont, Arizona Year 2001. Arizona Game and Fish Department, Phoenix, Arizona. 16pp.
- Ingraldi, M. and M. Bayless. 2004. Winter raptor inventory on Camp Navajo, Bellemont, Arizona Year 2004. Arizona Game and Fish Department, Phoenix, Arizona.
- Irvine, L. 1991. Disturbance and small mammals: effects of prescribed fire on white-footed mice (*peromyscus*). MS Thesis. Northern Arizona University.
- Knight, R.L. and D.N. Cole. 1995. Factors that influence wildlife responses to recreationists. In *Wildlife and Recreationists: Coexistence Through Management and Research*. Knight, Richard L. and Kevin J. Gutzwiller, editors. Island Press, Washington, D.C. 372 pp.
- Lowe, P.O., P.F. Ffolliott, J.H. Dieterich, and D.R. Patton. 1978. Determining potential wildlife benefits from wildfire in Arizona ponderosa pine forests. Gen. Tech. Rep. RM-52. Rocky Mountain Forest and Range Experiment Station.
- Martell, M. 1992. Bald eagle winter management guidelines. U.S. Fish and Wildlife Service, Region 3, Wisconsin. 12pp.
- Patton, D.R., and J. Gordon. 1995. Fire, habitats, and wildlife. Final Report submitted to USDA Forest Service, Coconino National Forest. 85 pp.
- Randall-Parker, T., and R. Miller. 2000. Affects of prescribed fire in ponderosa pine on key wildlife habitat components: preliminary results and a method for monitoring In Laudenslayer, W.F., P.J. Shea, B. Valentine, C.P. Weatherspoon, and T.E. Lisle (technical coordinators), *Proceedings on the Ecology and Management of Dead Wood in Western Forests*. November 2-4, 1999, Reno, NV, USDA General Technical Report PSW-GTR-181.
- Seamans, M.E., R.J. Gutierrez, C.A. May, and M.Z. Peery. 1999. Demography of two Mexican spotted owl populations. *Conservation Biology* 13(4):744-754.

- Sheppard, G. and A. Farnsworth. 1995. Fire effects and the use of prescribed fire in Mexican spotted owl habitat. *In* Proceedings First Conference on Fire Effects on Rare and Endangered Species and Habitats Conference, November 13-16, 1995. Coeur d'Alene, Idaho. Pgs 131-135.
- Smith, T.J. 1988. The effects of human activities on the distribution and abundance of the Jordan Lake –Falls Lake bald eagles. M.S. Thesis, Virginia Polytechnic Institute and State University, Blacksburg. 100pp.
- Stalmaster, M.V. 1983. An energetics simulation model for managing wintering bald eagles. *Journal of Wildlife Management* 47(1):349-359.
- Stalmaster, M.V. 1987. The bald eagle. Universe books. New York, New York. 227pp.
- Stalmaster, M.V. and J.L. Kaiser. 1997. Flushing responses of wintering bald eagles to military activity. *Journal of Wildlife Management* 61(4):1307-1313.
- Swarthout, E.C.H. and R.J. Steidl. 2001. Flush responses of Mexican spotted owls to recreationists. *Journal of Wildlife Management* 65(2):312-317.
- Swarthout, E.C.H. and R.J. Steidl. 2003. Experimental effects of hiking on breeding Mexican spotted owls. *Conservation Biology* 17(1):307-315.
- Knight, R.L. and D.N. Cole. 1995. Factors that influence wildlife responses to recreationists. *In* *Wildlife and Recreationists: Coexistence Through Management and Research*. Knight, Richard L. and Kevin J. Gutzwiller, editors. Island Press, Washington, D.C. 372 pp.
- Texas Regional Institute for Environmental Studies. 1996. Final Report Floral and Faunal Inventories, Camp Navajo, Arizona. Sam Houston University. 83pp.
- U.S. Fish and Wildlife Service (USFWS). 1967. Native fish and wildlife. Endangered species. *Federal Register* 32(48):4001. March 11, 1967.
- U.S. Department of the Interior (USDI), Fish and Wildlife Service. 1991. Mexican spotted owl status review. Endangered species report 20. Albuquerque, New Mexico.
- U.S. Department of the Interior (USDI), Fish and Wildlife Service. 1993. Endangered and Threatened Wildlife and Plants; final rule to list the Mexican spotted owl as threatened. *Federal Register* 58(49):14248-14271. March 16, 1993.
- U.S. Department of the Interior (USDI), Fish and Wildlife Service. 1995a. Recovery Plan for the Mexican Spotted Owl. Albuquerque, New Mexico.
- U.S. Department of the Interior (USDI), Fish and Wildlife Service. 1995b. Endangered and threatened species; bald eagle reclassification; final rule. *Federal Register* 50(17):35999-36010.

- U.S. Department of the Interior (USDI), Fish and Wildlife Service. 1999. Endangered and threatened wildlife and plants; proposed rule to remove the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. *Federal Register* 64(128):36454-36464.
- U.S. Department of the Interior (USDI), Fish and Wildlife Service. April 10, 2001. Biological opinion on the Forest Service's proposed wildland urban interface fuel treatments in New Mexico and Arizona, R2/ES-TE, CL 04-005. U.S. Fish and Wildlife Service, Region 2, Albuquerque, New Mexico.
- U.S. Department of the Interior (USDI), Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; final designation of critical habitat for the Mexican spotted owl; final rule. *Federal Register* 69(168):53182-53298. August 31, 2004.
- Ward, J.P. Jr., and W.M. Block. 1995. Mexican spotted owl prey ecology. Chapter 5 (48 pp) *in* Recovery Plan for the Mexican spotted owl. Vol. II. USDI Fish and Wildlife Service, Albuquerque, NM.
- Wilson, E.D. 1969. A resume of the geology of Arizona. University of Arizona Press, Tucson. 140pp.
- Wright, H.A., and A.W. Bailey. 1982. Fire ecology, United States and Canada. John Wiley and Sons, New York. Pages 297-303.